

Salamander Captures in Artificial Cover Objects (ACOs), Spring 2009- Spring 2013

Young Stand Thinning & Diversity Study (YSTDS)
Willamette National Forest, Oregon

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Executive Summary

This is an update of a report first compiled in 2009, and now includes the latest annual sampling in the 1st week of May 2013. Total number of salamanders captured in spring has been relatively consistent since 2010 (59, 57, 63, 44), though the distribution of captures among treatments has varied considerably. When total captures since 2009 are examined in a repeated-measures analysis-of-variance, significantly more salamanders, particularly *Ensatina*, were captured in Control stands than in Heavy Thin stands. Treatment differences for other species are not statistically significant. Overall salamander captures, probably driven by responses of *Ensatina*, appear to be positively related to the amount of residual canopy cover in the YSTDS treatments.

Background

Details concerning design and establishment of the Young Stand Thinning & Diversity Study (YSTDS) can be found at:

<http://andrewsforest.oregonstate.edu/research/related/ccem/yst/ystd.html>.

Field surveys of amphibians were a part of the YSTDS from the beginning, with little success in sampling adequate numbers of salamanders to make valid comparisons of the effects of the thinning treatments on amphibians.

Initial efforts to sample amphibians relied on pitfall trapping. During pre-treatment sampling (1991-1992), a 5x5 grid of pitfall traps, with 20-m spacing between traps, was deployed for 6-8 nights in each of the 16 Treatment Areas (TACs). This design yielded a total of 54 captures of 6 species of salamanders. Assuming 7 nights of deployment, this amounts to a capture rate of 1.9 salamanders per 100 trap-nights. During an initial bout of post-treatment sampling (1998-2001), the number of pitfalls was doubled and more evenly distributed throughout each TAC. This post-treatment design yielded 151 captures of 5 species of salamanders (2.7 captures/100 trapnights), as well as 4 individual

frogs and a single toad. These numbers come from a document written by Steve Garman at <http://andrewsforest.oregonstate.edu/research/related/ccem/pdf/smallmammals.pdf>.

At the beginning of a second period (2007-2009) of post-treatment sampling, we attempted to continue pitfall sampling using the same design used in 1998-2001. After only 3 days of simultaneous mammal and amphibian sampling in Oct 2007, it became clear that we had underestimated the resources required to do the work. Since the capture rate of salamanders was so low (0.67 captures per 100 trap nights), we decided to halt pitfall trapping and concentrate on mammal work. In lieu of pitfalls, we decided to try time-constrained search (TCS) sampling. In each TAC, we laid out 3 strip plots, each measuring 50 m by 4 m. Each plot was searched intensively for one person-hour, by turning over logs, bark, and other debris to expose salamanders. After sampling 12 of these plots, and capturing only 4 salamanders, this work was discontinued. Another attempt was made by Joan Hagar and Brenda McComb to implement the same TCS design in June 2008, again with disappointing results (2 salamanders in a day of work for 2 people).

Artificial Cover Objects

It was after this setback that the idea of using artificial cover objects (ACOs) was advanced. The board design used is detailed in:

Davis, T.M. 1997. Non-disruptive monitoring of terrestrial salamanders with artificial cover objects on southern Vancouver Island, British Columbia. *In* Amphibians in decline: Canadian studies of a global problem, D.M. Green, editor.

Below are two figures illustrating the ACO design.

Fig. **a** shows the measurements for placing the cedar laths on the baseboard of the assembly.

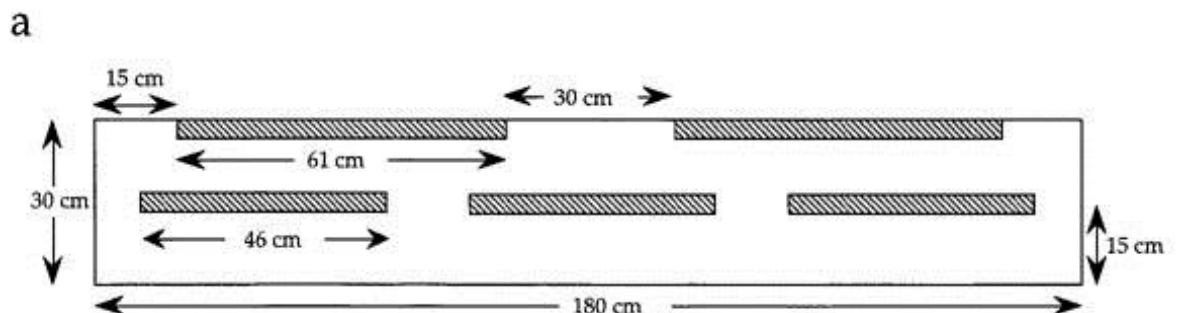
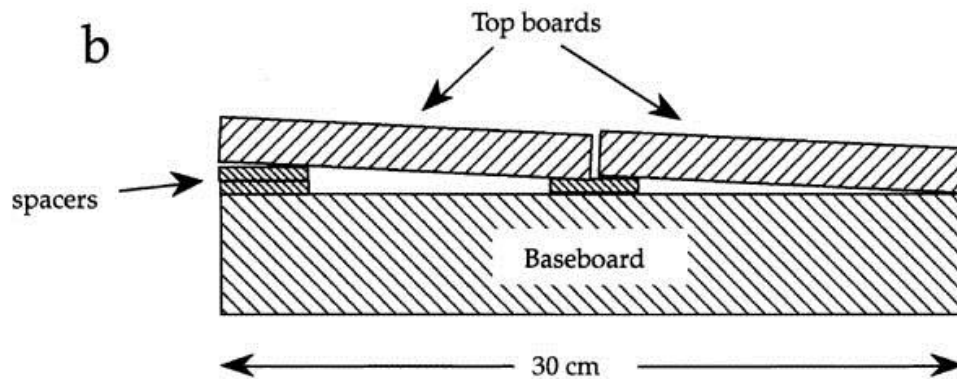


Fig. **b** shows a cross-section through the assembly to show how the placement of the smaller top boards on the laths creates tapering spaces within the assembly.



The ACOs were constructed of freshly milled Douglas-fir without any sort of anti-fungal treatment. The thickness of the baseboard was about 5 cm, and the topboards were about 3 cm thick. During September-October 2008, 3 of these devices were deployed within each TAC, at randomly-chosen locations within the mammal trapping transect arrays. Each location was marked with bright orange flagging, and GPS coordinates were recorded and stored. These GPS coordinates are stored permanently in the Forest Science Data Base (FSDB), along with the data from all surveys since they started in 2009.

Surveys of ACO's

Timing

ACO's were checked by Tom Manning once in the spring (June 4-5 & 25-26) and in the autumn (November 2-5) of 2009.

In November 2009, each TAC within a given block was sampled on the same day, to minimize any effects of differences in weather among days.

In May 2010, all of Blocks 3 & 4 were checked May 3, and all of Blocks 1 & 2 were checked May 4.

In November 2010, all of Blocks 3 & 4 were checked Nov 8, all of Block 1 on Nov 10, and all of block 2 on Nov 11.

In May 2011, all of Blocks 1 & 2 were checked on May 4, and all of Blocks 3 & 4 were checked on May 5.

In May 2012, all of Blocks 3 & 4 were checked on May 1, and all of Blocks 1 & 2 were checked on May 2.

In May 2013, all of Blocks 1 & 2 were checked on May 1, and all of Blocks 3 & 4 were checked on May 2.

Methods

At each ACO, the top boards were removed one at a time, and examined for salamanders. Next the main (bottom) board was lifted and the ground underneath examined for salamanders. Each salamander was placed in a small ziplock bag for weighing and measuring. Weight was measured with a 30-g Pesola spring scale to the nearest 0.5 gram. Snout-vent length (SVL) was measured with a small ruler to the nearest



Checking an ACO at Young Stand Thinning & Diversity Study, Treatment Unit 6

Results of ACO checks

During the June 2009 check of all 48 ACOs, only 2 salamanders were found. One was an ensatina (*Ensatina eschscholtzii*) and the other was a rough-skinned newt (*Taricha granulosa*).

In November 2009, a total of 11 salamanders were found. All but one were ensatinas, and the other was a clouded salamander (*Aneides ferreus*).

In May 2010, 59 salamanders were found. Again, *Ensatina* dominated the capture totals, with 75% of the total. For the first time I captured *Batrachoseps wrightii*, the Oregon slender salamander. *Aneides* continue to be captured in smaller numbers, though proportionately more than in the previous season. And again I caught a single newt.

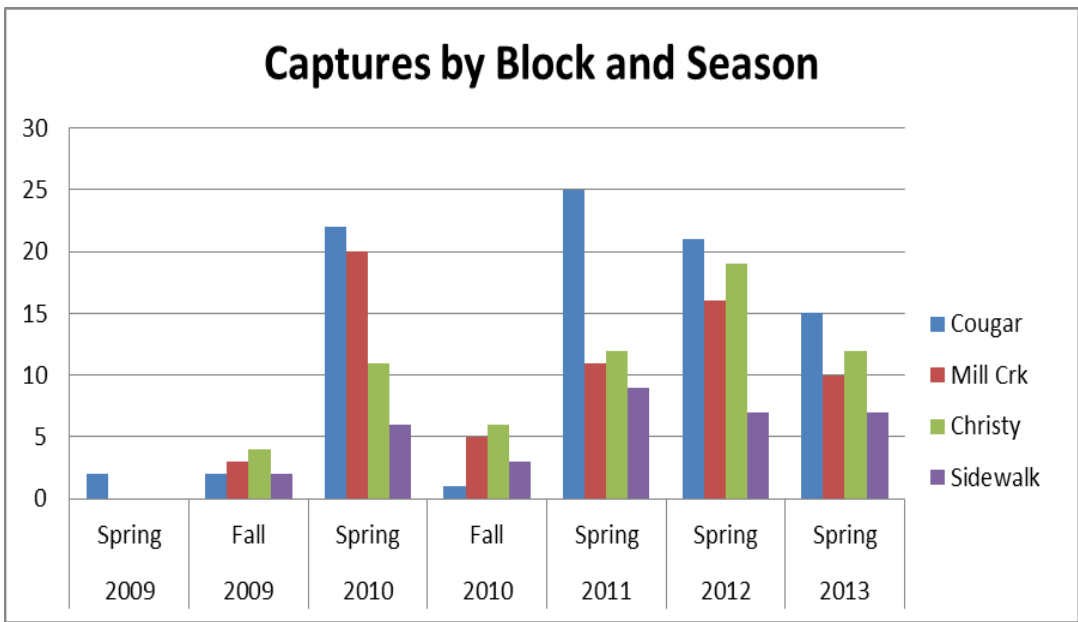
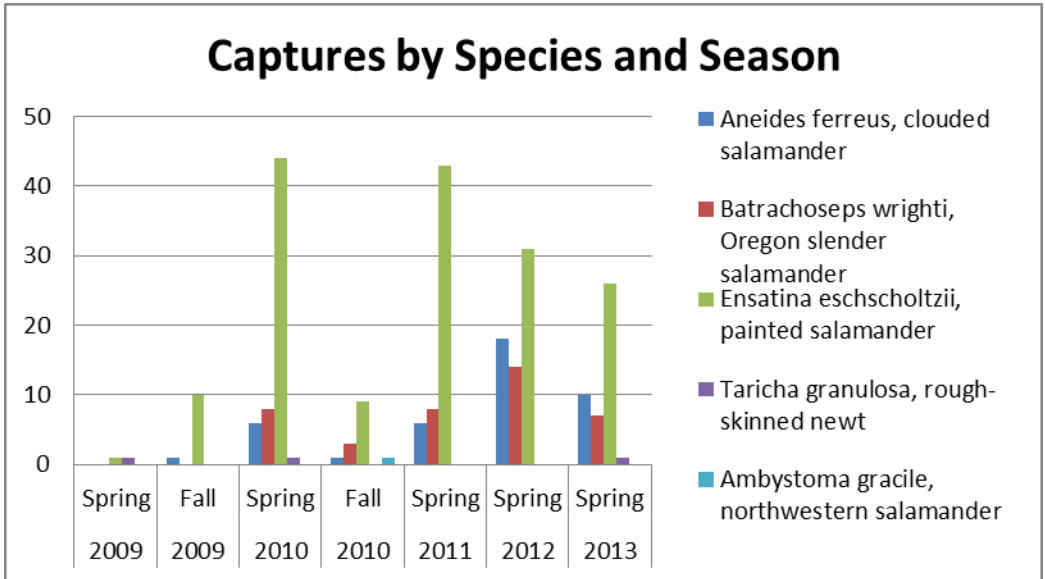
During November 2010, only 15 salamanders were found. Once again, *Ensatina* were the most common species (9 of 15). And for the first time, I captured a single northwestern salamander, *Ambystoma gracile*.

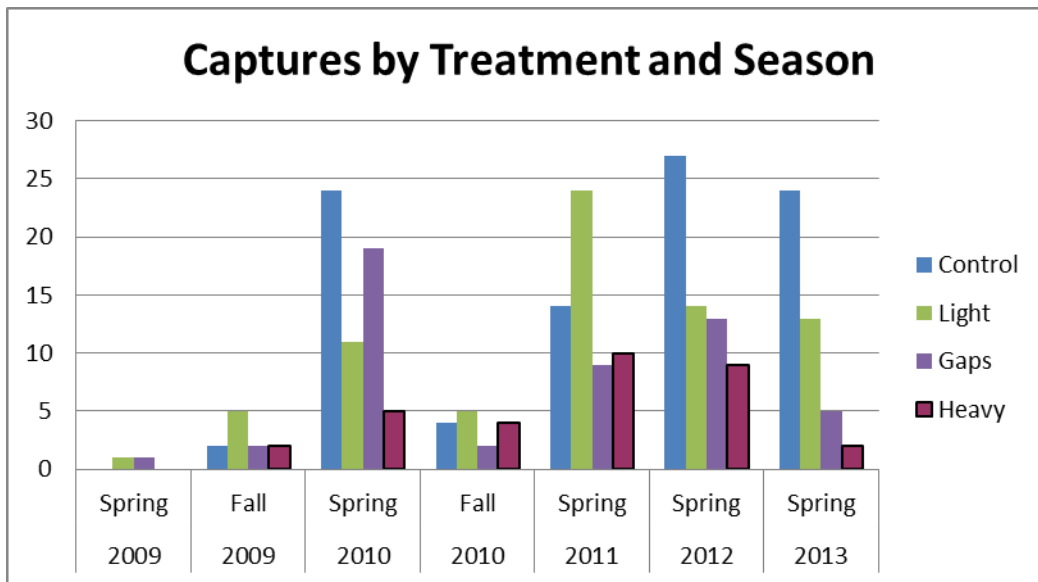
During May 2011, 57 salamanders were found. *Ensatina* were once again the commonest (43 of 57).

During May 2012, 63 salamanders were found. *Ensatina* were once again the commonest (31), but were not as dominant as in previous years, as there were 3 times as many *Aneides* (18) and nearly twice as many *Batrachoseps* (14) as in any previous year.

During May 2013, 44 salamanders were found. As usual, *Ensatina* were the most common (26 individuals).

On this and the next page, 3 figures illustrate the patterns of captures by season, species, treatment, and block.





Analysis and Discussion

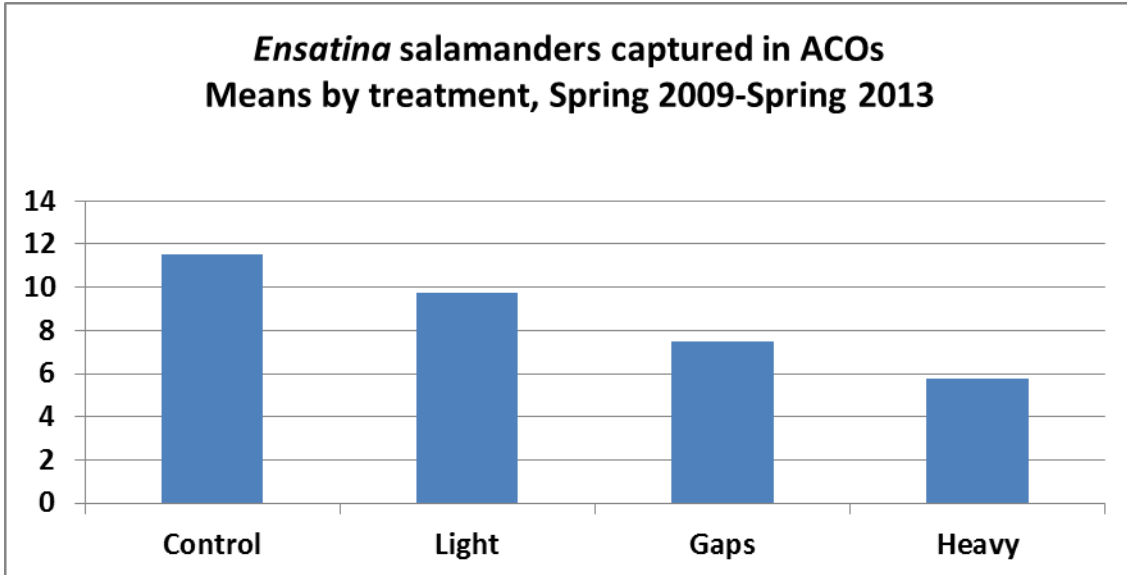
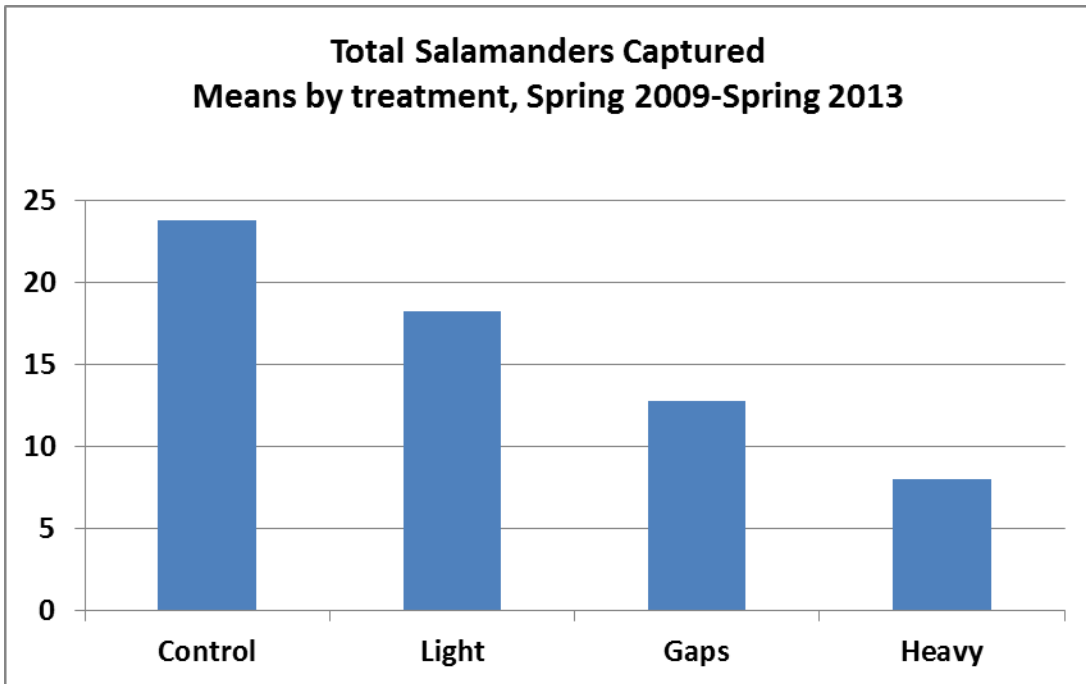
It was apparent that we were capturing many more salamanders in the spring than in the fall (disregarding the initial check in spring 2009), so we discontinued the fall checks after 2010. It's interesting that we caught almost the same total number of salamanders in spring 2010, 2011, and 2012 (59, 57 and 63 respectively), and that might suggest that we are catching the same animals repeatedly. However, the number of captures does not hold steady across treatments or blocks, so apparently this is just coincidence.

Overall, there is quite a bit of variation from year to year among the different blocks. Block 1 (Cougar) continues to have more salamanders than other blocks, and Block 4 (Sidewalk) continues to lag behind the other blocks in salamander captures.

In the latest analyses, including the spring 2013 data, I used a repeated-measures ANOVA design to test all data gathered in spring ACO checks since 2009. As before, I transformed all data using the "log +1" transformation, to correct for unequal variances. ANOVAs were run to examine for treatment effects in (1) all salamanders species collectively, with and without fall seasonal data, (2) for *Ensatina* only using fall and spring data, and (3) for the three common species (*Ensatina*, clouded salamander, and Oregon slender salamander) using only spring data.

Spring captures of salamanders (all species together) were very significantly higher in Control stands than in Heavy Thin ($P = 0.0075$), and marginally higher in Light Thin than in Heavy Thin ($P = 0.0518$); other inter-treatment differences were less pronounced (all $P > 0.11$). The difference between Control and Heavy Thin was slightly weaker ($P = 0.0336$) when fall data for 2009 and 2010 were included. The strength of this treatment difference appears to be driven by the responses of *Ensatina*, by far the most numerous salamander we captured: spring captures of this species alone were very significantly higher in Control stands than in Heavy Thin stands ($P = 0.0067$), but there were no significant differences among treatments for clouded salamanders, nor for Oregon slender

salamanders. Again, inclusion of the limited fall data obtained in 2009 and 2010 slightly weakens the treatment difference for *Ensatina* ($P = 0.0191$).



Miscellaneous Comments

In spring of 2013, two ACOs were not available for sampling. One in TAC 12 was removed from its placement and propped up vertically against the nearest tree, and another in TAC 16 was completely missing. A third ACO (in TAC 8) was covered by a felled tree, and was not sampled until the tree could be removed with a saw, on May 20.